b-tagging Using hbb and hdd Samples

K. Jyothsna Rani

# *Plan of the Talk*

- **Introduction**
- **Simulation framework**
- **Event kinematics**
- **b-jet tagging using H-disks**
- **Higgs mass resolution**
- **Summary**

Introduction

- **In SM Higgs boson coupling to b is rather weak $\sim m_b/v$.**

- **In SUSY models the b-quark coupling to Higgs bosons is enhanced by $\sim tan\,b$.**

- **Thus $\phi(=h,H,A)bb$ associated production cross-section expected to be large.**

- **Tevatron is a best place to study this process.**

Production of φbb
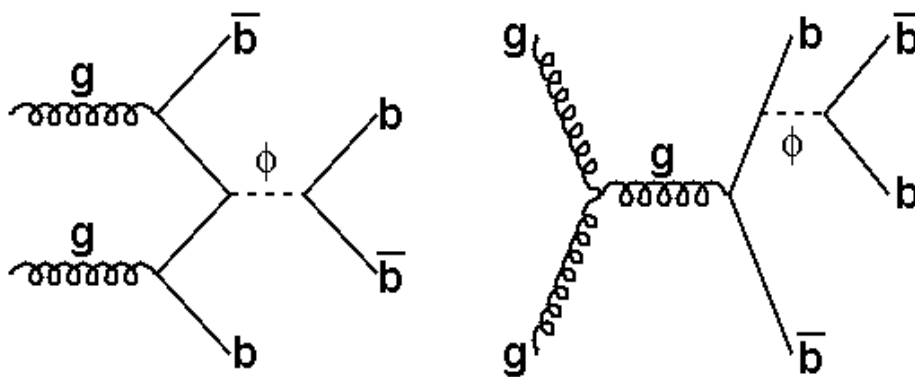
- **Leading Order Feynman Diagrams for the φ*bb* production.**

- **Final states are characterized by two central b-jets(from Higgs) and at least one forward jet.**

Simulation Framework

- **Simulation chain is done within mc_runjob framework(almost).**

- **Simulation chain consists of Gen$\rightarrow$ D0G* $\rightarrow$ Sim $\rightarrow$ Reco$\rightarrow$ Reco_analyze.**

- **Non standard features.**
  - **Have global tracks with H-disks ON/OFF.**
  - **Introduce several cone sizes in jet reconstruction package.**
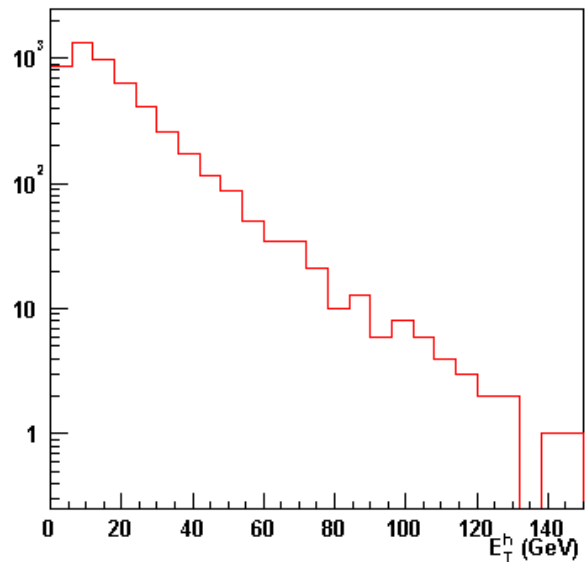
MC Samples

- **Available event samples.**
  - **bbh($\rightarrow$bb) 5K events for b-jet tagging performance.**
  - **ddh($\rightarrow$dd) 5K events for light quark jet mistag rate estimations.**
  - **No pile-up of minimum bias events superimposed.**
  - **Input Higgs mass = 120GeV.**
  - **tanβ = 1 and R(cone) = 0.5.**

Signal Kinematics(1)
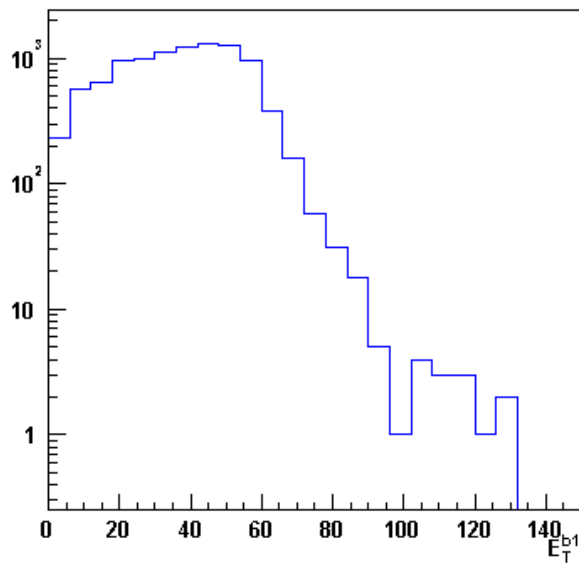
P_T distributions for

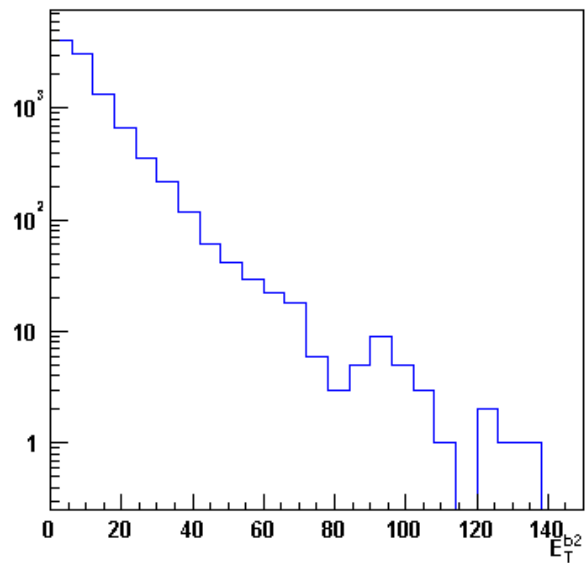- Higgs

- most and

- least energetic b's

in gg→hbb process

P_T of Higgs

P_T of b from Higgs

P_T

Signal Kinematics(2)

η distributions for

- Higgs

- most and

- least energetic b's
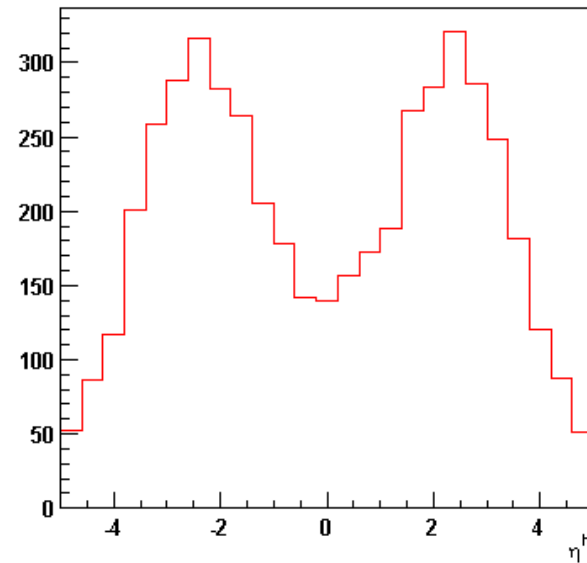
in gg→hbb process
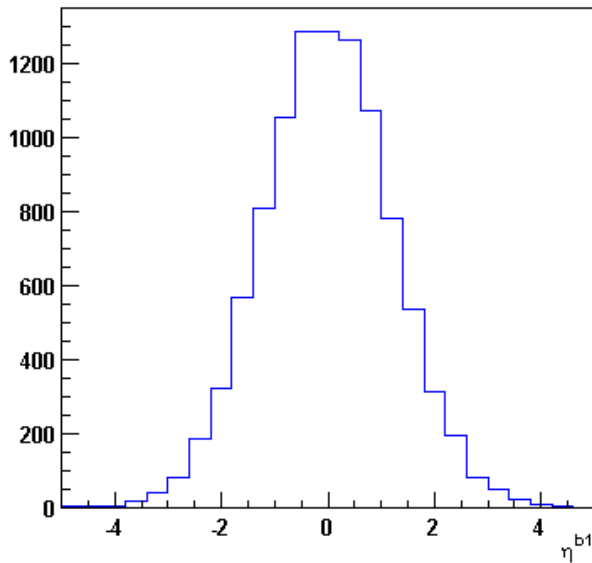
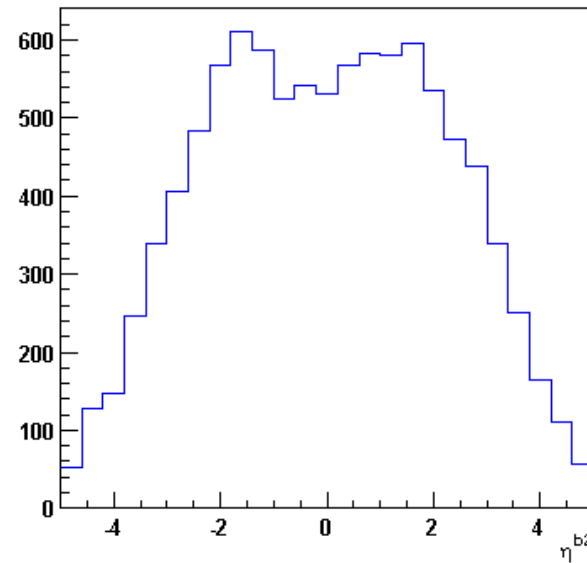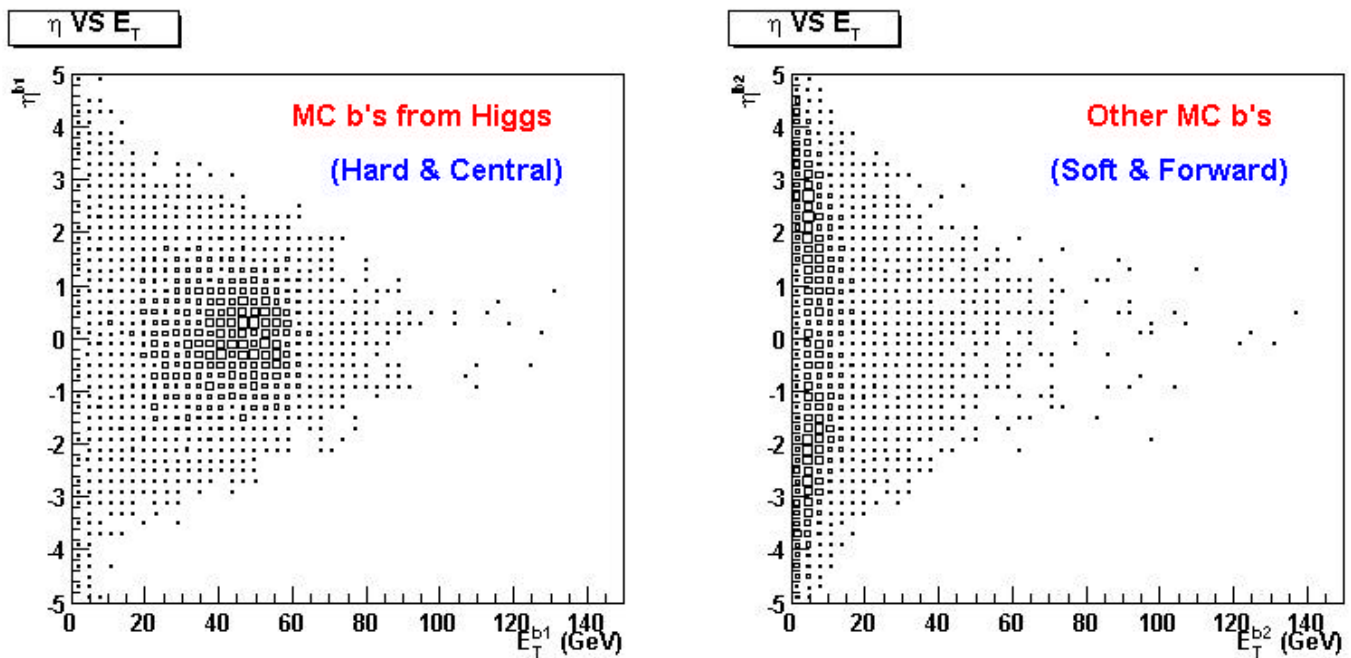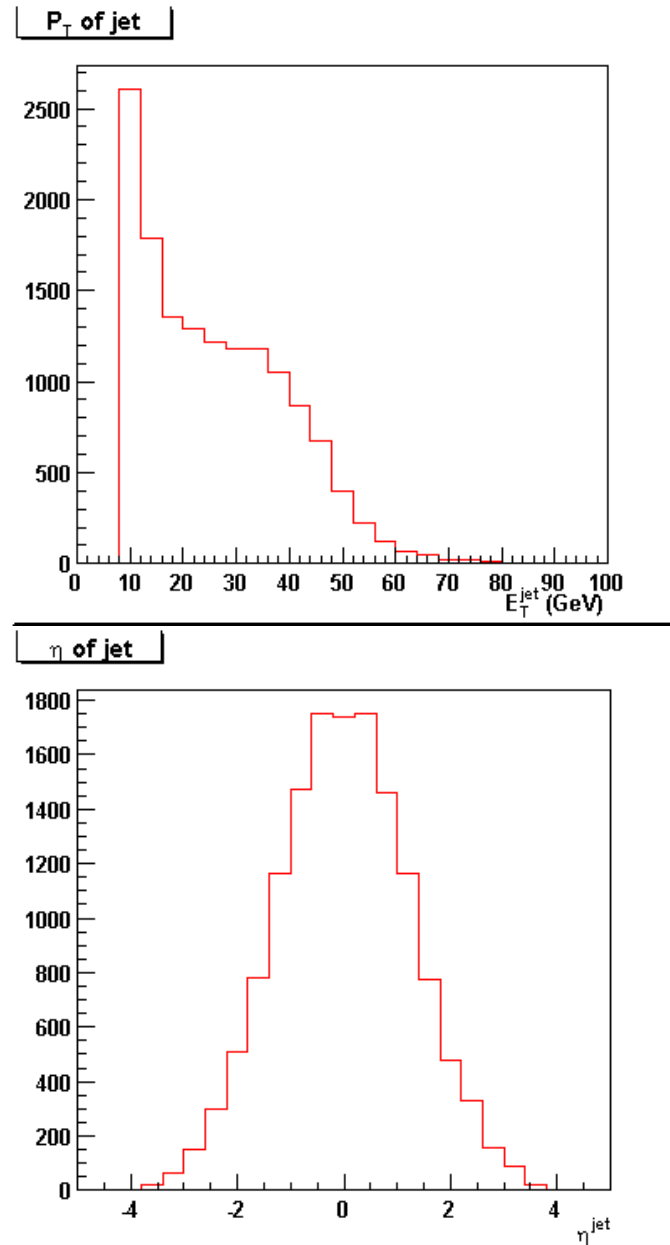# *Signal Kinematics(3)*

• η **vs E$_T$ correlations for MC b-jets**
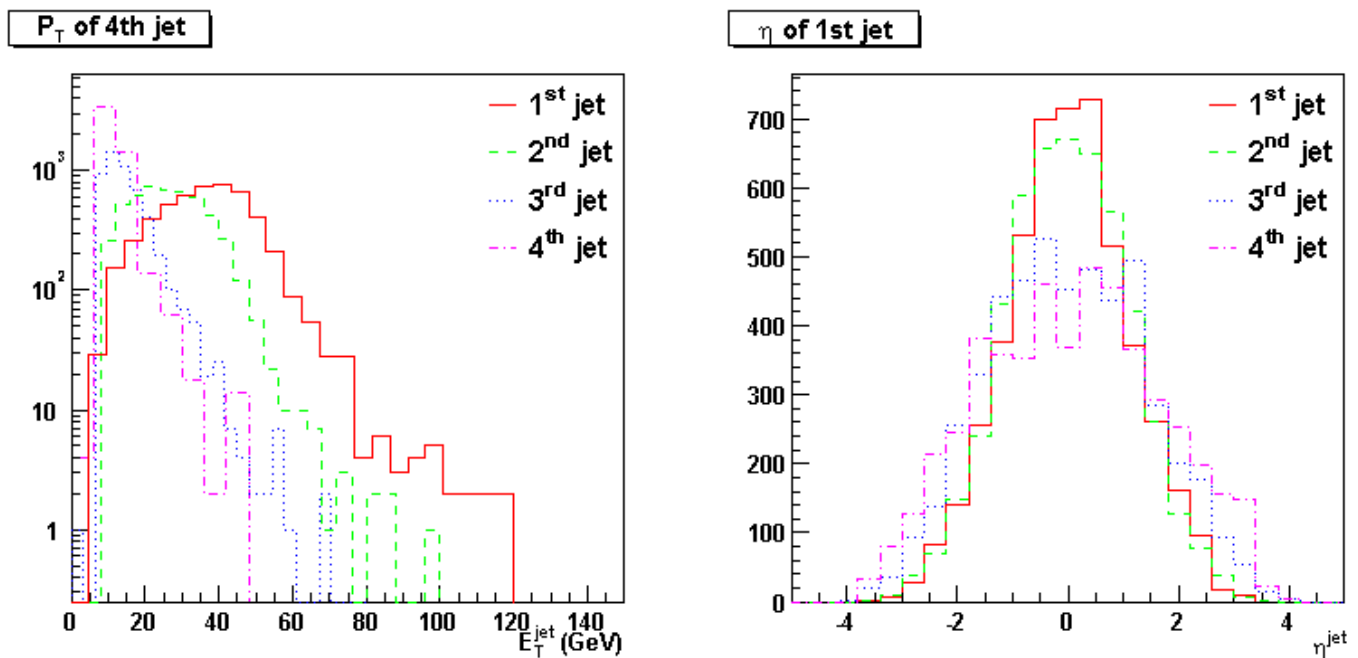

(Previous distributions were for MC).

Signal Kinematics(4)

- **Results for full detector simulation**
- **Jets are reconstructed with RunII cone algorithm**
- **R(cone) = 0.5**
- **ET > 8 GeV**
- **No jet energy correction**

P_T of jet

η of jet

Signal Kinematics(5)

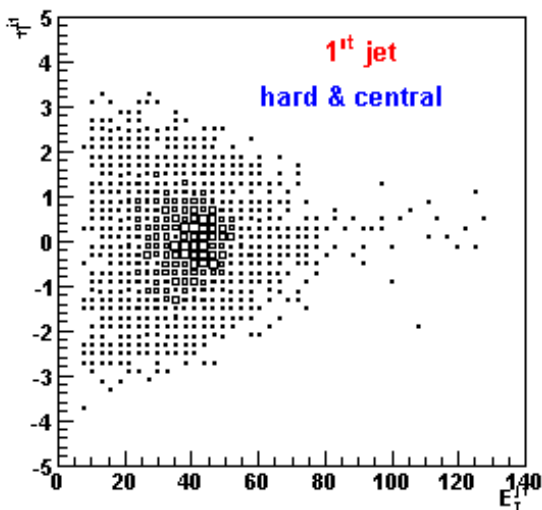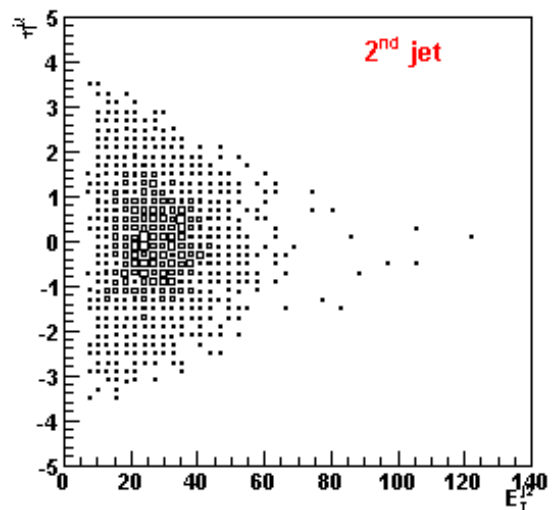## E_T and η distributions of 4 leading jets

- **Jets are not energetic**

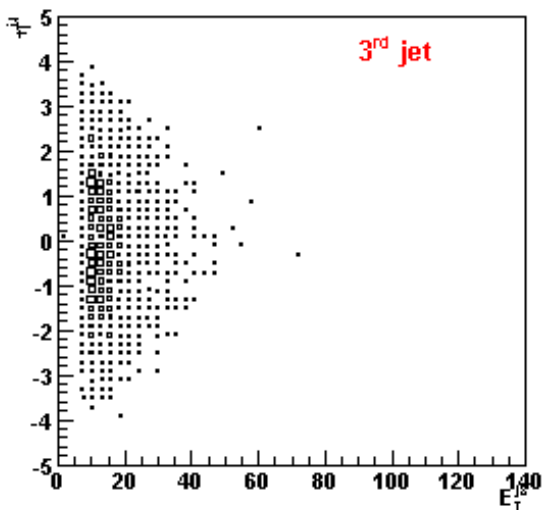# *Signal Kinematics(6)*

η vs E$_T$ correlation of 4 leading jets
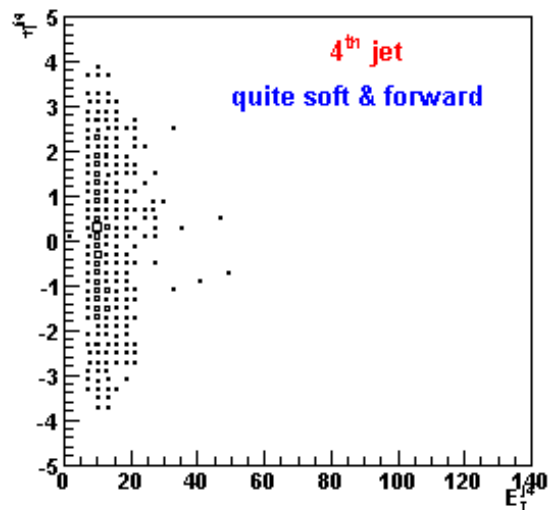
b-jet Tagging(1)

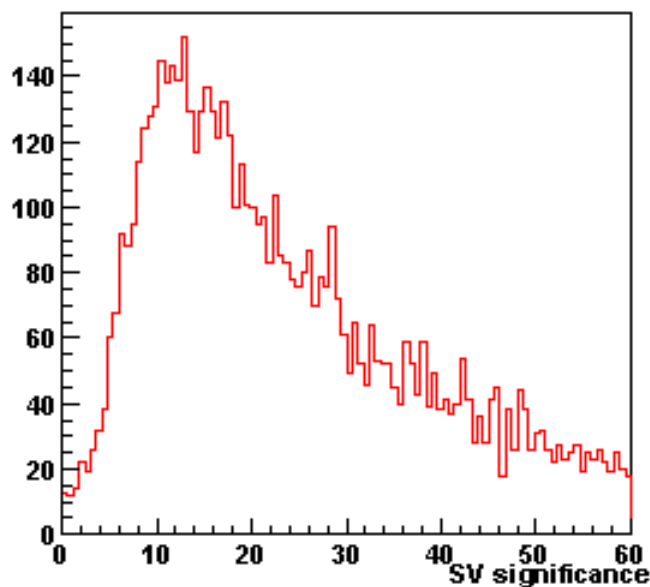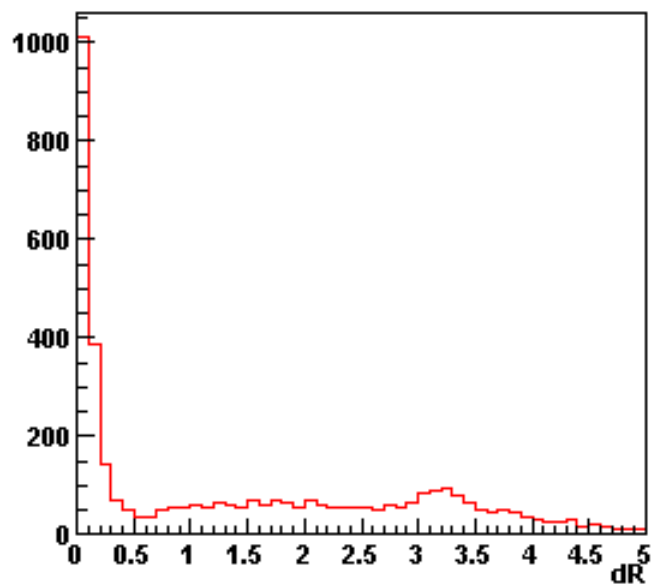**Jet tagging algorithm based on Secondary Vertex(SV) reconstruction using Kalman Filter**

- **Decay Length Sig. $L/\sigma > 3$**

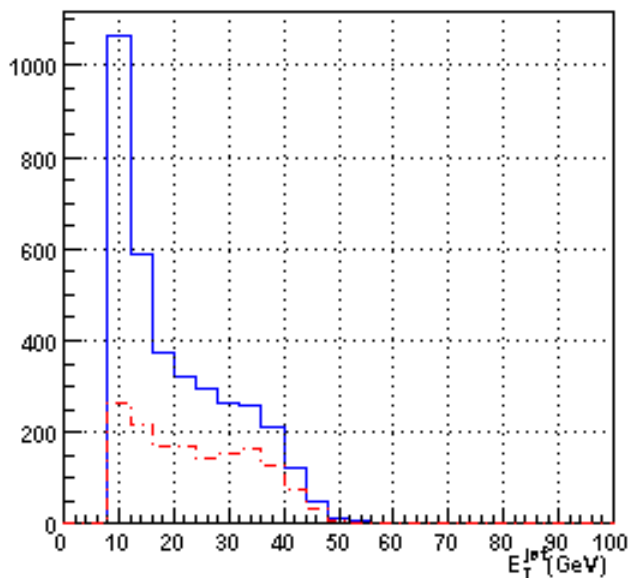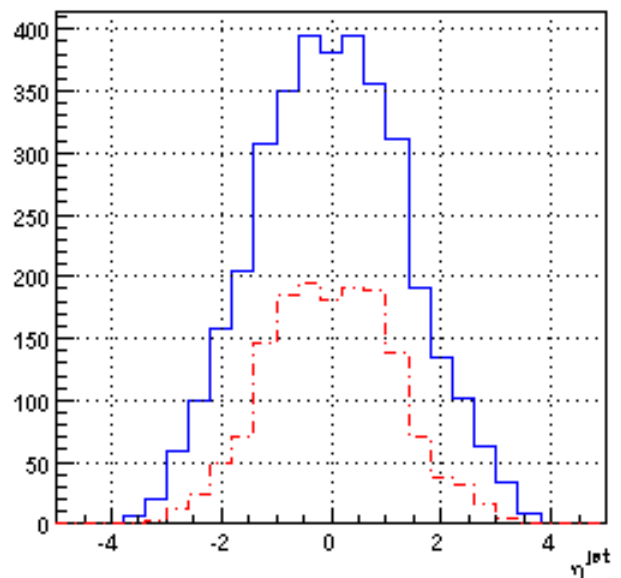- **Jet is SV-tagged if $\Delta R(SV, jet) < 0.3$**

Decay Length Significance

dR between jet and SV

b-jet Tagging(2)

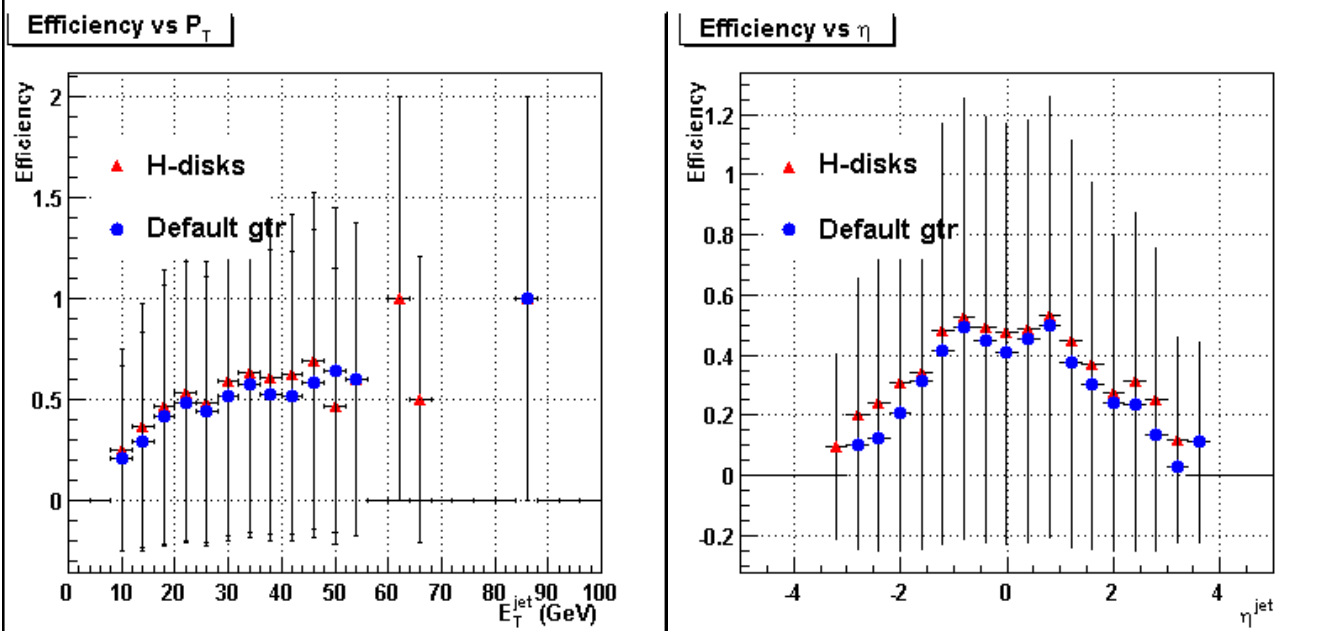## E_T and η Distributions for

b-tagged jet and b-jet

P$_T$ of MC matched b jet

η of MC matched b jet

Efficiency = b-tagged jets / all b-jets

b-jet Tagging(3)

E_T and η dependence of tagging efficiency

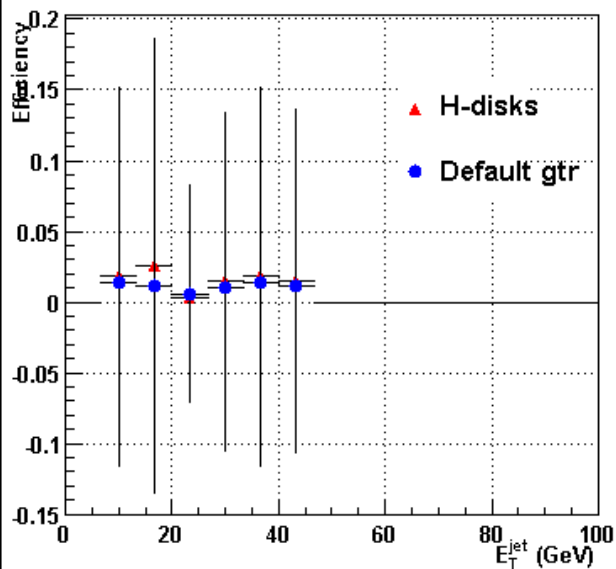• **Compare default gtr with H-disks ON**

• **With H-disks in gtr tagging efficiency has improved especially in forward regions.**
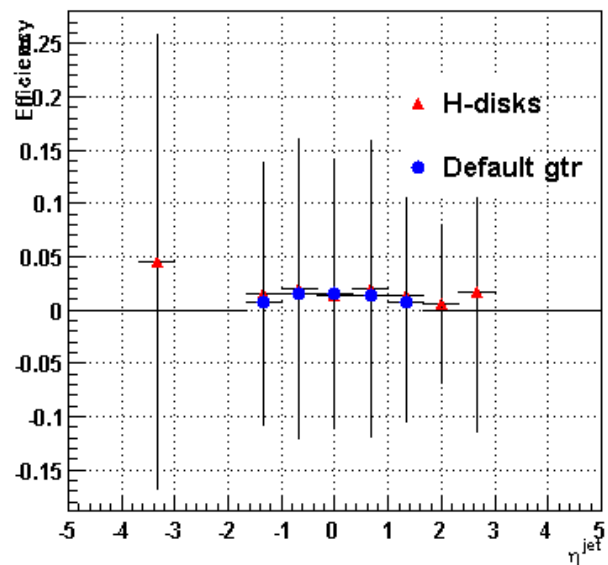
Mis-tagging Rate

- **Used sample ddh(→dd) 5K events**

- **Kinematics is like 4*b* case**

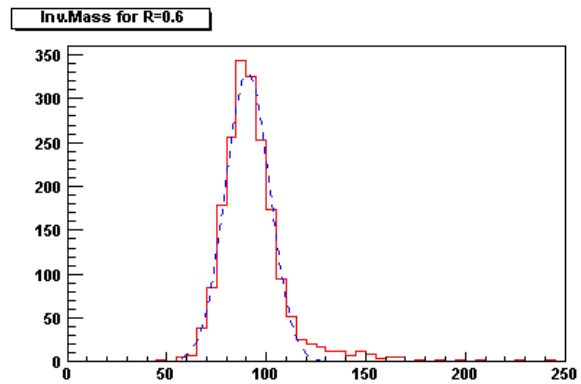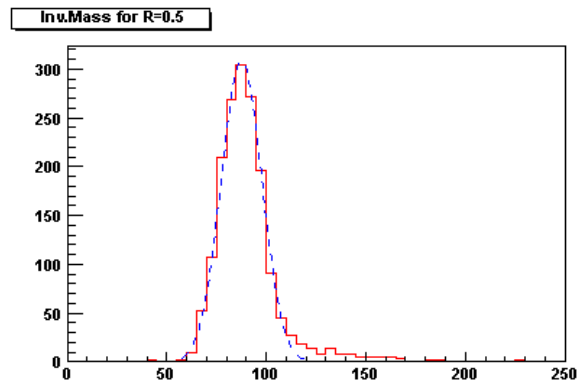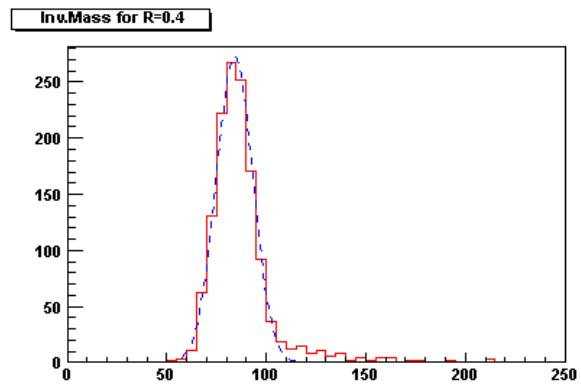- **Pass through same analysis chain as 4*b's***
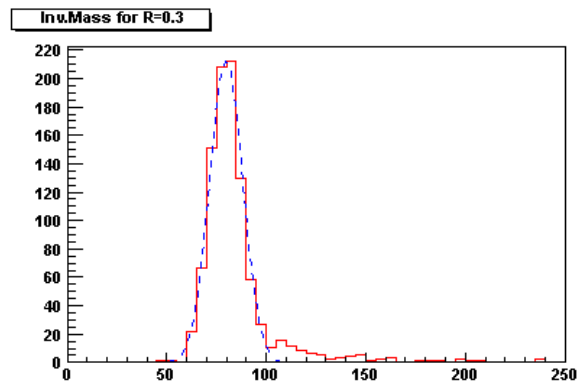

- **Mis-tag rates look similar with/without**

  H-disks.

Higgs Mass Resolution(1)
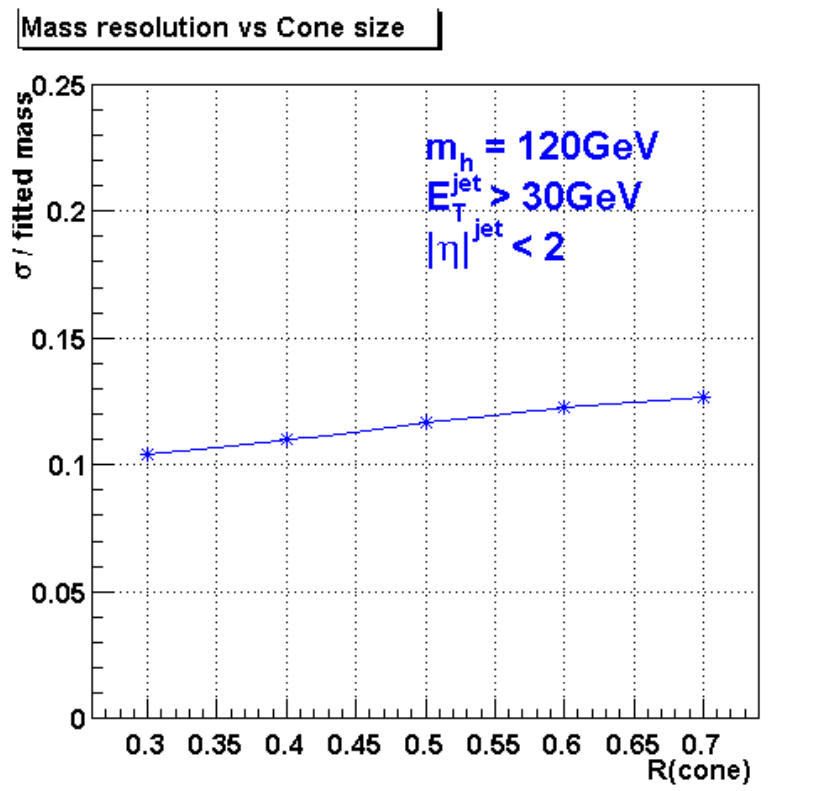
- **bb-jets(from Higgs) invariant mass distribution for jet $E_T > 30GeV$ in $|\eta| < 2$**
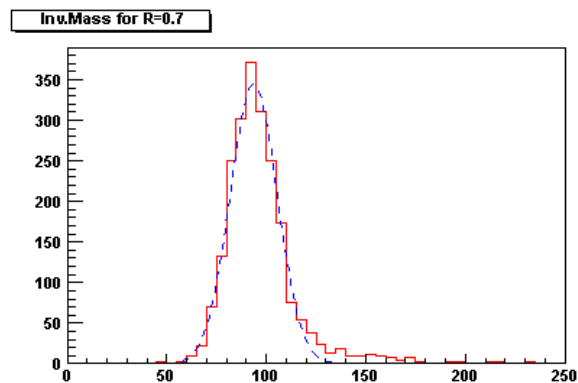
No Jet Energy Scale Correction.

Higgs Mass Resolution(2)

- **Mass resolution vs Cone size**

- **No corrections applied**

Smaller cone size is advantageous in terms of di-jet mass resolution.

Summary

- φ*bb* production has been looked at with detailed simulations.

- Possibility to improve b-tagging in forward region using H-disks has been investigated.

- Higgs mass resolution as a function of several cone sizes of jet reconstruction algorithm has been studied.